

**WHAT IS CLAIMED IS:**

1. A trench isolation method for forming a semiconductor device comprising:

5 forming an etching mask pattern on a semiconductor substrate to expose a predetermined region of the semiconductor substrate;

etching the exposed semiconductor substrate, using the etching mask pattern as an etching mask, to form a trench;

10 forming an insulating layer over the trench and nearby regions, the insulating layer filling the trench;

providing a material layer on the insulating layer, the material layer being formed at a temperature of 500°C and higher;

15 planarily etching the material layer and the insulating layer down to a top surface of the etching mask pattern to form a device isolation layer pattern in the trench; and

removing the exposed etching mask pattern.

2. The method of Claim 1, wherein the insulating layer is selected from a group of materials consisting of high density plasma (HDP) oxide or undoped silicate glass (USG).

20 3. The method of Claim 1, wherein the material layer consists of one selected from a group consisting of high temperature oxide (HTO), high temperature USG, polysilicon, and amorphous silicon.

4. The method of Claim 1, wherein forming the etching mask pattern includes:

forming a pad oxide layer on the semiconductor substrate;

5 forming an etch-stop layer on the pad oxide layer; and

patterning the etch-stop layer and the pad oxide layer to expose the predetermined region of the substrate.

5. The method of Claim 4, wherein the pad oxide layer is formed to a  
10 thickness of 20Å~200Å.

6. The method of Claim 4, wherein the etch-stop layer comprises silicon nitride with a thickness of 500Å~2000Å.

15 7. The method of Claim 4, wherein the etch-stop layer comprises a polysilicon layer and an HTO layer which are sequentially stacked.

8. The method of Claim 1 further comprising, prior to forming the insulating layer:

20 forming an oxide layer on an inner wall and bottom of the trench; and  
 forming an oxidation barrier layer on the oxide layer.

9. The method of Claim 8, wherein the oxide layer comprises thermal oxide or chemical vapor deposition (CVD) oxide with a thickness of 20Å~300Å.

10. The method of Claim 8, wherein the oxidation barrier layer comprises silicon nitride with a thickness of 20Å~300Å.

5 11. The method of Claim 8 further comprising forming a capping layer between the oxidation barrier layer and the insulating layer.

12. The method of Claim 11, wherein the capping layer is made of CVD oxide with a thickness of 20Å~300Å.